

REMARKS

1. In response to the Office Action mailed December 6, 2001, Applicants respectfully request reconsideration. Claims 1-24 were originally presented for examination. All the claims were rejected in the outstanding Office Action. By the foregoing Amendments, claims 1, 3, 4, 5, 8, 11, 12, 14-16 and 24 have been amended. Claims 2 and 23 have been canceled, and claim 25 has been added. Thus, claims 1, 3-22 and 24-25 are now pending in this application.

2. These amendments are believed not to introduce new matter and their entry is respectfully requested. Based upon the above Amendments and following Remarks, Applicants respectfully request that all outstanding objections and rejections be reconsidered, and that they be withdrawn.

Art of Record

3. Applicants acknowledges receipt of the form PTO-1449 filed by Applicants on March 19, 2001 (paper no. 4), which has been initialed by the Examiner indicating consideration of the references cited therein.

4. Applicants also acknowledges receipt of form PTO-892 (part of paper no. 5) listing additional references identified an by the Examiner.

Claim Rejections Under 35 U.S.C. §112, second paragraph

5. Claim 11 has been rejected under 35 U.S.C. §112, second paragraph. Claim 11 has been amended to remove the language referenced in this objection, thereby rendering the objection moot. Accordingly, reconsideration and withdrawal of this rejection is respectfully requested.

Rejections Under 35 U.S.C. §§ 102(b) & 103(a)

6. The Examiner has rejected claims 1, 2, 4, 5, 7, 12, 14, 18 and 19 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent 5,629,989 to Higgins, III (hereinafter "Higgins"). The Examiner also rejected claim 3 under 35 U.S.C. §103(a) as being unpatentable over Higgins in view of U.S. Patent No. 5,929,375 to Glovatsky et al. (hereinafter "Glovatsky"). Based on the above Amendments and following Remarks,

Applicants respectfully request reconsideration and withdrawal of these rejections.

7. Higgins is directed to an electromagnetic interference (EMI) shield formed of one or more conformal layers each filled with a selected type of filler particles to attenuate specific EMI frequencies. (See, for example, Abstract, col. 3, lns. 12-29.) The Higgins EMI shield includes a conformal insulative layer or coating 24 dispensed and cured over the die and other regions of substrate 16 which will be shielded to prevent emission or coupling of EMI. (See, col. 6, lns. 19-23.) Higgins also notes that coating 24 can be a filler polymer system with a particular filler material to achieve a desired insulative capability. (See, col. 6, lns. 32-35.)

8. The Examiner asserts that Applicants' claimed filler material is anticipated by Higgins' coatings 24, 60, 62 and/or 64. In paragraph 4 of the Office Action, the Examiner asserts that coatings 24, 60, 62, 64 cover a region of the circuit board having at least one cavity, identified by the Examiner as via or plated through-hole 20. The Examiner also asserts that coatings 24, 60, 62, 64 substantially cover the cavity such that the cavity is substantially inaccessible, and that the covered region has a contiguous, contoured surface. With regard to original claim 2, the Examiner asserts that Higgins coatings at least partially infill the cavity.

9. Applicants respectfully disagree. Reference numeral 20 of Higgins calls out plated through-holes, also known as vias, for routing selected traces, ground rings, pads or the like to internal conductive layers or planes. (See, col. 5, lns. 50-53.) Through-holes 20 are not cavities. Rather, through-holes 20 are a column of metallic material suitable for carrying signals from one layer of the printed wiring board to another. Furthermore, through-holes 20 in Figures 1 and 2 are plated through-holes for connecting an EMI ground ring 19 to an internal EMI ground ring 27, and insulating coating 24 to internal conducting layer 22. (See, col. 5, lns. 50-62; and col. 7, lns. 437-58.) There is no discussion whatsoever that intimates the Higgins conformal coating 24, 60, 62 and 64 infills any cavity in substrate 16. The coatings 24, 60, 62 and 64 of Higgins, therefore, neither bridge over cavity openings nor infill any cavity in substrate 16 as asserted by the Examiner.

10. Glovatsky, relied upon by the Examiner for its teaching of cavities being present between and between leads, does not disclose that which is missing from Higgins. Glovatsky is silent with regard to filler material and coatings for printed circuit boards.

11. However, to expedite prosecution, Applicants have amended independent claims 1, 12 and 22 to more clearly recite the claimed aspects of Applicants' invention. Amended claim 1, for example, recites a printed circuit board comprising "an electrically non-conductive filler material disposed in the cavity and on the surface of the printed circuit board immediately surrounding the cavity so as to bridge across the one or more cavity openings and to at least partially infill the cavity, wherein the cavity is substantially inaccessible to subsequently-applied coatings." As noted, Higgins via 20 is not a cavity. Nor does coating 24 at least partially infill and bridge over via 20. Further, there is no suggestion to at least partially infill cavities on the substrate 16 prior to applying coating 24. In fact, there is no discussion whatsoever of the problems or issues associated with cavities on substrate 16. Higgins, therefore, neither teaches nor suggests Applicants' invention as recited in amended independent claim 1.

12. As noted, Glovatsky does not provide that which is missing from Higgins. Thus, without addressing the propriety of the proposed combination of Higgins and Glovatsky, Applicants respectfully assert that these two references, taken alone or in combination, fail to disclose or suggest a filler material that infills and bridges over cavities on a printed circuit board as recited in amended claim 1. Accordingly, Applicants respectfully request that the rejection of independent claim 1 be reconsidered and that it be withdrawn.

13. Independent claim 12 is patentable for at least the same reasons as those noted above with respect to claim 1. Claim 12, as amended, recites a printed circuit board "having a device body mounted on said printed wiring board to form one or more regions of the printed circuit board having a highly variable and cavitatious surface including a plurality of cavities defined by an series of component leads, the component body adjacent the series of leads, and a portion of the printed wiring board below the series of leads, wherein each cavity includes a plurality of openings to the surface of the printed circuit board." The printed circuit board also includes "a layer of non-electrically-conductive filler material conformingly adhered to printed circuit board surfaces in the one or more regions to provide a contoured, contiguous filler material surface having

gradual transitions, wherein the filler material bridges across the cavity openings and at least partially infills the cavities.” (See, amended claim 12, above.)

14. For at least the reasons noted above with respect to claim 1, Applicants assert that Higgins taken alone or in combination with Glovatsky neither teaches nor suggests the recitations of amended independent claim 12. There is no teaching or suggestion to fill the cavities in Higgins and Glovatsky with “a layer of non-electrically-conductive filler material conformingly adhered to printed circuit board surfaces ... to provide a contoured, contiguous filler material surface..., wherein the filler material bridges across said cavity openings and at least partially infills the cavities.” Applicants therefore respectfully assert that independent claim 12, as amended, is patentable over the art of record, and requests that the rejection of claim 12 be reconsidered and withdrawn.

15. Independent claim 22 is directed to a method for manufacturing a printed circuit board. The claimed method includes “applying a high viscosity, non-electrically-conductive filler material to said at least one cavity such that said filler material bridges across the opening of the cavity and at least partially infills the cavity so as to provide a contoured, contiguous filler surface over the at least one cavity; and applying one or more layers of a low viscosity, high adherence dielectric coating to predetermined portions of said printed circuit board including said at least one cavity.” (See, amended claim 22, above.)

16. Higgins taken alone or in combination with Glovatsky neither teaches nor suggests performing at least the recited steps of applying a high viscosity, non-electrically-conductive filler material followed by applying one or more layers of a low viscosity, high adherence dielectric coating to a printed circuit board. Higgins, as noted, teaches applying a layer of conformal insulative coating 24. There is no suggestion of coating the board with another insulative material prior to applying coating 24. Nor is there any suggestion to apply multiple layers of coating 24. Furthermore, Higgins is silent with regard to viscosity of any of the coatings 24, 60, 62 and 64. Accordingly, Applicants assert that claim 22, as amended, is patentable over the art of record. Reconsideration and withdrawal of the rejection of claim 22 is respectfully requested.

Dependent Claims

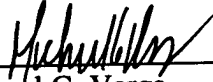
17. The dependent claims in this application depend directly or indirectly from independent claims 1, 12 and 24, and incorporate all of the subject matter of their respective independent claim. Furthermore, these dependent claims add additional subject matter which makes them independently patentable in and of themselves over the art of record. Accordingly, Applicants respectfully request that the rejections of the dependent claims currently pending in this application be reconsidered, and that they be withdrawn.

CONCLUSIONS

18. Applicants respectfully assert that this application is now be in condition for allowance. A notice to this effect is respectfully requested. The Examiner is asked to contact the Applicants' representative at the number provided below once he/she has had an opportunity to review these Amendments to conduct a substantive interview on the merits of this application.

Respectfully submitted,

Lowell E. Kolb *et al.*

By: 
Michael G. Verga
Registration No. 39,410
Tel. (617) 244-0490

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MARKED UP VERSION OF CLAIMS SHOWING ALL CHANGES MADE

**[ATTACHMENT 1 TO THE AMENDMENT FILED IN RESPONSE TO THE OFFICE ACTION
DATED DECEMBER 06, 2001 IN U.S. PATENT APPLICATION 09/813,257.]**

1. (Amended) A printed circuit board comprising:

a printed wiring board;

a plurality of components mounted on said printed wiring board, wherein the printed circuit board has a cavity with one or more openings to the surface of the printed circuit board; and

[a high viscosity,] an electrically non-conductive filler material [covering a region of the printed wiring board having at least one cavity,]

[wherein said filler material] disposed in the cavity and on the surface of the printed circuit board immediately surrounding the cavity so as to bridge across the one or more cavity openings and to at least partially infill the cavity, wherein the [substantially covering said infilled] cavity [such that said covered cavity] is substantially inaccessible [and that said covered region has a contiguous, contoured surface] to subsequently-applied coatings.

3. (Amended) The printed circuit board of claim 1, wherein [at least one of said plurality of cavities is between and beneath leads of a component.] the cavity comprises:

a volume of space defined by the leads of a component, the component body and the printed wiring board, wherein the volume of space has a plurality of openings to the surface of the printed circuit board between neighboring component leads.

4. (Amended) The printed circuit board of claim 1, wherein the cavity [at least one of said cavities] comprises:

a volume of space [is] between neighboring components mounted on the printed wiring board.

5. (Amended) The printed circuit board of claim 1, wherein the cavity [at least one of said cavities] comprises:

a volume of space [is] between a component mounted on the printed wiring board and the printed wiring board.

8. (Amended) The printed circuit board of claim 7, [9,] wherein said epoxy is one of the family of Bisphenol-A epoxies mixed with an amine hardner.

11. (Amended) The printed circuit board of claim 1, wherein the [said filler material is one of a plurality of different filler materials.] subsequently-applied coating comprises:

a layer of dielectric coating that conformingly coats exposed surfaces of the printed circuit board including the filler material, the dielectric coating formed of a low viscosity material that facilitates accurate application of the dielectric coating using a spray atomized technique, wherein at least one of the one or more cavity openings is sufficiently large to prevent the dielectric coating from bridging across the cavity opening without the presence of the filler material.

12. (Amended) A printed circuit board comprising:

a printed wiring board;

a plurality of components having a device body mounted on said printed wiring board to form one or more regions of the printed circuit board having a highly variable and cavitatious surface including a plurality of cavities defined by an series of component leads, the component body adjacent the series of leads, and a portion of the printed wiring board below the series of leads, wherein each cavity includes a plurality of openings to the surface of the printed circuit board; and

a layer of [that is coated with a high viscosity,] non-electrically-conductive filler material conformingly adhered to printed circuit board surfaces in the one or more regions to provide a contoured, contiguous filler material surface having gradual transitions, wherein the [said] filler material bridges across the cavity openings and at least partially infills the cavities [in the one or more regions of said printed circuit board].

14. (Amended) The printed circuit board of claim 12, [13,] wherein said filler material is an epoxy.

15. (Amended) The printed circuit board of claim 14, further comprising:

a low viscosity, high adherence dielectric coating that, when applied and cured, covers predetermined portions of said printed circuit board including at least a portion of the one or more regions [said region] coated with said filler material, wherein the filler material prevents the dielectric coating from entering the plurality of cavities.

16. (Amended) The printed circuit board of claim 15, further comprising:

a [low viscosity] conductive coating covering said dielectric coating and portions of the [said] printed circuit board not covered by the [said] dielectric coating, wherein the [said] dielectric coating and the [said] conductive coating form a conformal EMI shield that adheres to and conforms with the printed wiring board surfaces.

22. (Amended) A method for manufacturing [preparing] a printed circuit board [to receive a board-level coating,] comprising the steps of:

providing the printed wiring [circuit] board;

mounting a plurality of components on the printed wiring board, wherein at least one cavity having an opening to the surface of the printed circuit board is formed;

applying [coating selected cavitations and highly variable regions of said printed circuit board with] a high viscosity, non-electrically-conductive filler material[,] to said at least one cavity such that said filler material bridges across the opening of the cavity and at least partially infills the cavity so as to provide [provides] a contoured, contiguous filler surface [across said region.] over the at least one cavity; and

applying one or more layers of a low viscosity, high adherence dielectric coating to predetermined portions of said printed circuit board including said at least one cavity.

24. (Amended) The method of claim 22, [23,] further comprising:

applying a low viscosity conductive coating over said dielectric coating and portions of said printed circuit board not covered by said dielectric coating,

wherein said dielectric coating and said conductive coating form a conformal EMI

shield that adheres to and conforms with the printed wiring board surfaces.

25. (New) The printed circuit board of claim 11, further comprising:
a conductive coating applied to surfaces of at least said dielectric coating.